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TUBERCULOSIS.

TO WHAT DEGREE IS IT SPREAD BY ASSOCIATION IN HOUSEHOLDS?

In April, 1913, Dr. Edward R. Baldwin of Saranac Lake read a paper before the "Laennec," a society for the study of tuberculosis, of Johns Hopkins Hospital. The paper, entitled "Allergy and reinfection in tuberculosis," was published in the Johns Hopkins Hospital Bulletin for July, 1913. The paper has attracted considerable attention, largely because of the misconstruing of the author's conclusions, and has been the subject of editorial comment in both the medical and lay press.

Dr. Baldwin expressed the opinion that adults are very little endangered by close contact with cases of open tuberculosis and not at all in ordinary association, as practically everyone is infected before reaching adult life and by this infection acquires a degree of immunity against reinfection from others.

In a letter of February 15, 1914, Dr. Baldwin makes the following statement in regard to the subject:

The conclusions which were contained in this paper related to the relatively slight danger of infection in adult life as compared with childhood. Incidentally, I stated that the fear of infection was grossly exaggerated so far as adults were concerned, but I in no way implied that there was no danger of tuberculous infection. The greater danger in childhood was contrasted strongly with that of adults, the reasoning being that as most adults had during their earlier life received more or less infection which had not progressed and largely had become healed, by this means they had acquired some protection against reinfection from outside sources.

In this same connection a study on the spread of tuberculosis in families, recently made in Minneapolis by Herbert G. Lampson, is of especial interest. The investigation was supervised by a committee of which Dr. Geo. D. Head was chairman, and the report was published in December, 1913, as a bulletin of the University of Minnesota.

As a result of his work Lampson concluded that the spread of tuberculous infection in families where open cases of tuberculosis exist is greater than it is generally understood to be.

The two conclusions, one arrived at largely by a careful study of experimental work, the other by a study of families, in some of which were recognized cases of tuberculosis, and in the others no recognized cases, and which are in agreement at least in so far as the recognized danger to children is concerned, are of such interest that they will be given in full.

Baldwin's conclusions are:

In conclusion it seems pertinent to make some practical use of our knowledge of allergy in tuberculosis. If some things sound too speculative, and my deductions are pivoted on too small points, yet we are reasonably sure of some things. These are (a) that most adults have received some tuberculous infection; (b) that a variable degree of specific allergy is thus acquired; (c) that during ordinary health the tissues repel tubercle bacilli, partly with the aid of specific allergy; (d) reinfection is mostly autogenous superinfection and due to disease, overstrain, trauma, or any cause of lowered vitality, whatever that may mean. Finally, (e) as a corollary, adults are very little endangered by close contact with open tuberculosis, and not at all in ordinary association. Childhood is the time of infection, youth the time of superinfection, and that from extension of the primary disease.

Qualify these statements as we may, it is time for a reaction against the extreme ideas of infection now prevailing. There has been too much read into the popular literature by health boards and lectures that has no sound basis in facts, and it needs to be dropped out or revised. More protection of children and better hygiene for adults are logically demanded, but beyond this the preachments about the danger of infection to adults in the present state of society are without justification from an *experimental* standpoint. Deductions from case histories must be accepted without much doubt, when circumstantial evidence is presented showing the source of infection to be recent exposure in adult life. This is particularly applicable to the question of hospital and dispensary contact for nurses and resident staffs. It also applies to alleged infection of married partners, already the subject of careful investigation, without producing satisfactory proof of infection. (Weinberg, Pope, and Pearson.)

Phthisiophobia has had no check from the time the knowledge of the bacillus was popularized. Cornet's dust experiments first gave the impulse to a fear, followed by Flugge's droplet infection, which has aggravated the solicitude felt by physicians and nurses and which has been gradually spread to the laity. Not until the researches that I have briefly laid before you have we had much to show the way to a more correct judgment of the real danger to adults.

Lampson states that the plan of investigation carried out in his work was as follows:

1. Select a given number of families in each of which a case of pulmonary tuberculosis existed at the time of the investigation and which had been living for at least a year prior to the investigation in the home of each of these families.
2. Prove the case to be one of tuberculosis by the finding of tubercle bacilli in the sputum or other excreta.
3. Make a careful scientific study of all the individuals in these families and determine which of them show evidence of tuberculous infection.
4. Make a similar study in a given number of families in which no persons with tuberculosis had been found, and compare these findings with the findings in the tuberculous families.

The recorded results of Lampson's work were as follows:

In 33 families classed as containing open cases of pulmonary tuberculosis, 173 individuals were examined. Of those examined, 124 individuals showed evidence of tuberculous infection, 41 showed no evidence of tuberculous infection, and 8 individuals were doubtful or suspicious. These suspicious cases were those which showed more or less signs of tuberculous infection but gave a negative Von Pirquet test; or not showing physical signs, gave an atypical reaction to the tests employed. All those classed as infected with tuberculosis gave a typical reaction to the tuberculin tests. Of the 8 suspicious cases, 1 has since been declared tuberculous at the University Dispensary and 1 has had a pulmonary hemorrhage; both were adults and neither is included in the list of tuberculous infections.

Among the 124 showing evidence of tuberculous infection are the 23 living center cases. Deducting the 23 center cases, we have 101 individuals presumably infected from 33 open center cases, or $3\frac{2}{3}$ for each case. Excluding the center cases, 67 per cent of the individuals exposed showed evidence of infection with the tubercle bacillus.

In 4 families classed as containing latent center cases, 22 individuals were examined. Of those examined 8 showed evidence of tuberculous infection and 3 were suspicious. Deducting the 4 center cases, we have a spread of infection in 22 per cent of individuals exposed.

In 3 families classed as containing healed center cases, 12 individuals were examined. Of the 12 examined, 6 showed evidence of tuberculous infection. Deducting the 3 center cases, we have a spread of infection in 33 per cent of the individuals exposed.

In 10 families classed as containing nontuberculous center cases, 56 individuals were examined. Of the 56 examined, 1 individual showed evidence of tuberculous infection, and 2 were suspicious, an infection of 1.7 per cent of all individuals in the household.

In 5 families classed as controls and containing no reported or suspected cases of tuberculosis, 24 individuals were examined. Of those examined, 1 showed evidence of tuberculous infection, 4.1 per cent of all individuals in the household.

Dividing all families examined into two classes, tuberculous and nontuberculous, there were 40 tuberculous families and 15 nontuberculous families. In the 40 tuberculous families 207 individuals were examined, of whom 138 individuals showed evidence of tuberculous infection. In the 15 nontuberculous families 80 individuals were examined, of whom 2 showed evidence of tuberculous infection and 2 were suspicious. That is, $66\frac{2}{3}$ per cent of individuals examined in tuberculous families showed evidence of tuberculous infection, and $2\frac{1}{2}$ per cent of the individuals examined in nontuberculous families showed evidence of infection with tuberculosis.

Among the 40 tuberculous families there are 10 families containing 54 individuals, of whom every member was examined, and in which every member showed evidence of tuberculous infection.

Three families containing 12 members, of whom 7 were examined, showed evidence of tuberculous infection in all those examined.

His conclusions were:

I conclude from the above studies, first, that the spread of tuberculous infection in families where open cases of tuberculosis exist is greater than it is generally understood to be. Sixty-seven per cent of the individuals of these families, excluding the center cases, show evidence of tuberculous infection. In no case where there has been definite proven exposure of a family to an open case of tuberculosis, no matter what precautions have been taken, have I failed to find a spread of infection. In at

least 10 cases investigated the infection has spread to the limit of available material. Every member of these 10 families shows evidence of tuberculous infection.

Second, that in families where no cases of tuberculosis have been found, no matter what the home life or living conditions were, the number of individuals showing evidence of tuberculous infection was small, namely $2\frac{1}{2}$ per cent.

Third, that in families where cases of latent tuberculosis exist, the spread of infection is not as great as in families where open cases of tuberculosis are found, 22 per cent against 67 per cent.

Fourth, that in families where healed cases of tuberculosis are present, the spread of infection is less than in families where open cases exist, 33 per cent against 67 per cent.

Fifth, that in families where no tuberculosis is found, the number of individuals showing evidence of infection is very small ($2\frac{1}{2}$ per cent), in comparison with the families in which open, latent, or healed tuberculosis exists.

Baldwin's conclusions, as previously stated, were based largely upon an analytical study of the experimental work which has been done on immunity and the susceptibility of a once-infected animal to superinfection or reinfection.

Lampson's conclusions, on the other hand, were based on an epidemiologic study of families. It is possible that a number of the individuals in tuberculous families whom he found to react to tuberculin and in many of whom he found clinical symptoms suggesting tuberculous infection had but received the infection which most of those who live to adult life are presumed to receive in one way or another, and which usually produces a degree of immunity. Many of these individuals may never become actively tuberculous. However, the marked difference between his findings in families in which there were recognized cases of tuberculosis and in those in which there were not was so great that his work assumes an unusual significance in public health administration. Similar investigations should be carried on by health departments in other cities to ascertain whether the conditions of household infection found by Lampson in Minneapolis exist elsewhere.